

WHAT WE CLAIM ARE:

1. A planarized ultra fine particle film forming method for forming a planarized ultra fine particle film from a deposited film of ultra fine particles formed by supplying the ultra fine particles to a substrate, the method comprising one or more of a planarizing step of planarizing a surface of the deposited film of the ultra fine particles supplied to the substrate.
2. A planarized ultra fine particle film forming method according to claim 1, wherein the ultra fine particles are ceramic or metal ultra fine particles.
3. A planarized ultra fine particle film forming method according to claim 1, wherein said planarizing step rolls, scrapes, grinds or polishes a surface layer portion of the deposited film of the ultra fine particles supplied to the substrate.
4. A planarized ultra fine particle film forming method according to claim 1, wherein said planarizing step presses a surface layer portion of the deposited film of the ultra fine particles supplied to the substrate.
5. A planarized ultra fine particle film forming method according to claim 1, wherein the deposited film is either applied with a mechanical impulse force, which is equal to or higher than Vickers hardness of the ultra fine particles, to the ultra fine particles supplied to the substrate to crush the ultra fine particles and make the particles bond together, or not applied with the mechanical impulse force.

6. A planarized ultra fine particle film forming method according to claim 5, wherein the mechanical impact force is applied to the deposited film: by accelerating ultra fine particles by an electrostatic field or gas transport and spraying the particles to and colliding the particles with the ultra fine particles on the substrate; by using a brush or roller rotating at high speed, a pressure needle moving up and down at high speed, or a piston moving at high speed by explosion force; or by generating ultra sounds.

7. A planarized ultra fine particle film forming method according to claim 5, wherein in accordance with the mechanical impact force to be applied to the ultra fine particles, the ultra fine particles are processed so that the ultra fine particles can be easily crushed with the mechanical impact force in excess of a mechanical strength or a brittle fracture strength of the ultra fine particles.

8. A planarized ultra fine particle film forming method according to claim 7, wherein processing the ultra fine particles is: adjusting a preliminary baking temperature of source ultra fine particles; heating ultra fine particles prepared to have a particle diameter of about several tens nm and aggregating the particles to form secondary particles having a particle diameter of about 50 nm to 1 μ m; or forming cracks in ultra fine particles so as to make the particles easy to be crushed, by using for a long time period milling apparatus, a breaker or crusher such as a ball mill, a jet mill, a vibration mill, an epicyclic mill and a bead mill.

9. A planarized ultra fine particle film forming method according to claim 1, wherein the deposited film is formed by applying an ion beam or plasma to the ultra fine particles supplied to the substrate.

10. A planarized ultra fine particle film forming apparatus for forming a planarized ultra fine particle film from a deposited film of ultra fine particles formed by supplying the ultra fine particles to a substrate, the apparatus comprising at least one of: an attached particle removal apparatus for rolling or scraping a surface layer portion of the deposited film of the ultra fine particles supplied to the substrate; a film surface processing apparatus for grinding or polishing the surface layer portion; and a pressure apparatus for pressing the deposited film.

11. A planarized ultra fine particle film forming apparatus according to claim 10, wherein the substrate and said attached particle removal apparatus or said film surface processing apparatus are structured to be movable relative to each other.

12. A planarized ultra fine particle film forming apparatus according to claim 10, further comprising a mechanical impact force, which is equal to or higher than Vickers hardness of the ultra fine particles, loading apparatus for loading a mechanical impact force to the ultra fine patterns of the deposited film.

13. A planarized ultra fine particle film forming apparatus according to claim 10, further comprising a radiation apparatus for radiating an ion beam or plasma to the ultra fine patterns of the deposited film.

14. A planarized ultra fine particle film forming method for forming a planarized ultra fine particle film from a deposited film of ultra fine particles formed by supplying the ultra fine particles to a substrate, the method comprising one or more of a planarizing step of planarizing a surface of the deposited film of the ultra fine particles by blowing planarizing fine particles having a grinding/polishing function at an oblique incidence angle toward the surface of the deposited film.

15. A planarized ultra fine particle film forming method according to claim 14, wherein the planarizing fine particles are accelerated by using an electrostatic field or gas and blown toward the surface of the deposited film of the ultra fine patterns.

16. A planarized ultra fine particle film forming method according to claim 14, wherein the incidence angle of a flow of the planarizing fine particles relative to the substrate is in a range of - 60 degrees to - 5 degrees or + 5 degrees to + 60 degrees.

17. A planarized ultra fine particle film forming method according to claim 14, wherein the planarizing fine particle have a same composition as that of the ultra fine particles.

18. A planarized ultra fine particle film forming method according to claim 14, wherein the planarizing fine particle have a particle diameter larger than that of the ultra fine particles.

19. A planarized ultra fine particle film forming method according to claim 14, wherein the planarizing fine particle have a rigidity higher than that of the ultra fine particles.

20. A planarized ultra fine particle film forming apparatus for forming a planarized ultra fine particle film from a deposited film of ultra fine particles formed by supplying the ultra fine particles to a substrate, wherein planarizing fine particles having a grinding/polishing function are blown at an oblique incidence angle toward the surface of the deposited film.

21. A planarized ultra fine particle film forming apparatus according to claim 20, further comprising a spray apparatus such as a nozzle and an electrostatic acceleration gun for jetting out, at the same time or separately, the ultra fine particles and the planarizing having the grinding/polishing function, toward the substrate, and a center axis of a jet flow of said spray apparatus being set in an incidence angle range of - 60 degrees to - 5 degrees or + 5 degrees to + 60 degrees relative to a surface of the substrate.

22. A planarized ultra fine particle film forming apparatus according to claim 20, further comprising a spray apparatus such as a nozzle and an electrostatic acceleration gun for jetting out, at the same time or separately, the ultra fine particles and the planarizing having the grinding/polishing function, toward the substrate, and a flow of the ultra fine particles or planarizing particles jetted out from said spray apparatus being set to have a conical shape having an incidence angle range of - 60 degrees to - 5

degrees or + 5 degrees to + 60 degrees about a center axis of a jet flow of
said spray apparatus.

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